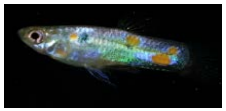

Poecilia reticulata: Domestic Breeder Trait Matrix Reference Guide

Database Maintained by Alan S. Bias & Carl Groenewegen

Note: All photos by author(s), from published research, or by express permission of owners (*unlisted for size*).

Purpose: *The purpose of the publication is to provide Domestic Guppy breeders with a Scientifically Published (primary) and Breeder Documented (secondary) Knowledge Base. One that will encompass known Genetics, Genetic normals, abnormals & anamolies, Wild-Type & Domestic precursor traits for color & pattern. It* ***does not attempt*** *to decipher specific phenotypes. Only provide the means to understand them.*

Updates: *Periodic as old or new knowledge is acquired or published. Suggestions and input welcome with source documentation and photos to* ***alansbias@aol.com*** *or* ***cgroen9079@aol.com***

Column A *- Reference Name: By Scientific Description if formally published, Breeder Terminology if Not Published.*

Column B *- Trait Type: Listed by Categories; Genetic - Normal / Abnormal, Body - Color / Pattern, Finnage - Color / Pattern, Finnage - Shape, Wild-Type Research.*

Column C *- Formal Genotype: Published Putative Genotype.*

Column D *- Informal Breeder Genotype: Documented Breeder Putative Genotype.*

Column E *- Mode of Inheritance: By Formal Publication, if lacking Breeder Documentation or Suspicion.*

Column F *- Description of Interactions: Brief Description of Trait in Abstract.*

Column G *- Other Names: Also Known As or See Other Linked / Similar Trait(s) Reference Name.*

Column H *- Formal Publication: By Author(s) / Year(s).*

Columns I & J *- Examples: Photo's or Drawings from Research first, Evidentuary Photo second.*

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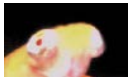
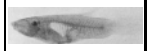
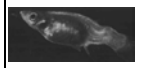
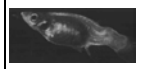
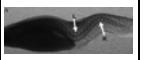
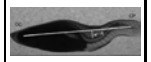
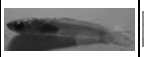
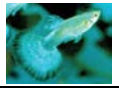
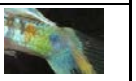
REFERENCE NAME	TRAIT TYPE	FORMAL GENOTYPE	INFORMAL BREEDER GENOTYPE	MODE OF INHERITANCE	DESCRIPTION OF INTERACTIONS	OTHER NAMES	FORMAL PUBLICATION: AUTHOR / YEAR	EXAMPLE No. 1	EXAMPLE No. 2
Bubble Eye	Genetic - Normal / Abnormal			Autosomal "Unknown"	Abnormal; Protrusion of eyes, both sexes.	Bubble Eye, Big Eye.			
Coecus	Genetic - Normal / Abnormal	cs		Autsomal Recessive	Abnormal; Blindness. cscs (homo), Cscs (hete) and CsCs (non-Coecus).		Kirpichnikov 1981, referenced		
Congenital Nanism (Dwarfism)	Genetic - Normal / Abnormal			Autosomal "Unknown"	Abnormal; Retardation of growth and lack of development in secondary sexual characteristics and ornaments.		Schröder1969c		

	A	B	C	D	E	F	G	H	I	J
31	**Heterogametic Females**	Genetic - Normal / Abnormal	XY		XY	Abnormal; Females with different sex (one male / one female) chromosomes	Heterogametic, Hermaphrodites, Mules	Blacher 1928 (suspected), Winge & Ditlevsen 1938, Schröder 1969c, Kavumpurath 1993		
32	**Heterogametic Males**	Genetic - Normal / Abnormal	XY		XY	Normal; Males with different sex (one male / one female) chromosomes	Heterogametic	Winge 1922a 1922b 1930 1934, Blacher 1927, Kavumpurath 1993, Tripathi 2009		
33	**Homogametic Females**	Genetic - Normal / Abnormal	YY		YY	Abnormal; Females with same sex (two male) chromosomes.	Homogametic Female	Yamamoto 1967, Haskins 1970, Kavumpurath 1993		
34	**Homogametic Females**	Genetic - Normal / Abnormal	XX		XX	Normal; Females with same sex (two female) chromosomes		Blacher 1927, Winge 1930 1934, Kavumpurath 1993, Tripathi 2009		
35	**Homogametic Males**	Genetic - Normal / Abnormal	XX		XX	Abnormal; Males with same sex (two female) chromosomes. Such males used as sires will only produce female offspring and only pass X-linkeded genotype for traits.	Homogametic Male	Winge 1930 1934, Dzwillo 1962 1966, Kirpichnikov 1981, Kavumpurath 1993, Tripathi 2009		
36	**Homogametic Males**	Genetic - Normal / Abnormal	YY		YY	Abnormal; Males with same sex (two male) chromosomes. Such males used as sires will only produce male offspring and pass Y-linkeded genotype for traits.	Homogametic Male	Winge & Ditlevsen 1938, Yamamoto 1967, Haskins 1970, Kavumpurath 1993		
37	**Kyphosis (Hunch-back)**	Genetic - Normal / Abnormal	hb		Autosomal Recessive or Polygenic Combination	Abnormal; Form of scoliosis; Spinal deformity, arched back and large distended abdoman. Reduced vertibrae structure. Dorsoventral curvature in spine shape. hbhb (homo), Hbhb (hete) and HbHb (non-Kyphotic).	Balloon Body, See: Lordosis (Abnormis) and Lordosis (Palla)	Goodrich 1943, Schröder 1969 1969c, *Kyphosis testing references.*		
38	**Lordosis (Abnormis)**	Genetic - Normal / Abnormal	abn		Autosomal Recessive or Polygenic Combination	Abnormal; Shorting and compression of the caudal peduncle, due to fusion of the last caudad vertebrae. Sometimes with malformed caudal fin. Breeding results suggestive of a common polygenic base for all curvatures. abnabn (homo), Abnabn (hete) and AbnAbn (non-lordotic).	See: Lordosis (Abnormis) and Lordosis (Palla)	Harrison, in abstract Goodrich 1934, Kirpichnikov 1935, Schröder 1969 1969c		
39	**Lordosis (Curvatus)**	Genetic - Normal / Abnormal	Cu		Autosomal Dominant or Polygenic Combination	Abnormal; Dorsoventral curvature of the spine. Similar to "wavy" mutant in Medaka. CuCu (homo), Cucu (hete) and cucu (non-lordotic).	See: Lordosis (Sc).	Kirpichnikov 1935, Schröder 1969 1969c		
40	**Lordosis (Palla)**	Genetic - Normal / Abnormal	Pa		Autosomal Dominant or Polygenic Combination	Abnormal; Characterized by vertebral fusions, viable sperm, almost totally unable to copulate. Gonopodium often malformed and verticalized, interfering with movement. Lethal in homozygotes. Considered disinct from Lordosis (Abnormis). PaPa (homo), Papa (hete) & papa (non-lordotic).	See: Lordosis (Abnormis) and Kyphosis (Hunch-back)	Lodi 1978, Kirpichnikov 1981, referenced		
41	**Lordosis (Spine Curved)**	Genetic - Normal / Abnormal	sc		Autosomal Recessive	Abnomality; Spine Curved (Sc). Severe dorsoventral curvature of the spine. Caudal portion may bend sideways in form of an "S". Present at birth, easily discernable. Lordotic mutation is an autosomal, single factor, recessive to normal. scsc (homo), Scsc (hete) and ScSc (non-lordotic).	Lordotic, Lorodose, Spine Curved. See: Curvatus (Cu)	Rosenthal & Rosenthal 1945a, Schröder 1969		
42	**Raised Protrusion (Koi)**	Genetic - Normal / Abnormal			Autosomal "Unknown"	Abnormal; Variable expressivity suggestive of autosomal dominant. Homozygous expression with raised raspberry protrusions; abnormal growth. Heterozygous expression lacking protrusions.				
43	**Raised Protrusion (Pink)**	Genetic - Normal / Abnormal		Pk + NiII	c	Abnormal; Raised raspberry protrusions; abnormal growth. Occasionally occuring near caudal / peduncle juncture.		Groenewegen 2013, *unpublished data*		

	A	B	C	D	E	F	G	H	I	J
44	**Scoliosis (Curveback)**	Genetic - Normal / Abnormal	No notation provided		Autosomal Recessive or Polygenic Combination	Abnormal; Manifests as a primary sagittal lordosis of variable magnitude, some kyphosis. Vertebral breakage or fusion not asscoaited with curveback. Distribution of curve magnituted among adult fish suggest polygenic inheritance.		Gorman & Breden 2007		
45	**Swimm Bladder Defect**	Genetic - Normal / Abnormal			Autosomal "Unknown"	Abnormal; Individuals with swimm-bladder defects cannot swim up and down by changing their specific gravity. Most remain small without reaching sexual maturity. Commonly express excessive melanophores.	Belly Sliderss	Schröder 1969c		
46	**Albino 1 (Type B RREA)**	Body - Color / Pattern	a		Autosomal Recessive	Likely tyrosinase deficient; inability to convert tyrosine into melanin. Inability to produce black melanophores in body and finnage. aa (homo), Aa (hete) and AA (non-albino).	Real Red Eye Albino (RREA), Pink Eye Albino	Haskins & Haskins 1948		
47	**Albino 2 (Type A WREA)**	Body - Color / Pattern	lu	l	Autosomal Recessive	Likely tyrosinase positive; enzyme present, with reduced melanin production. Eyes dark "Burgundy" color. lulu (homo), Lulu (hete) and LuLu (non-Lutino).	Wine Red Eye Albino (WREA), Lutino, Ruby Eye Albino	Kempkes 2007		
48	**Albino 3 (Type C Singapore)**	Body - Color / Pattern			Autosomal Recessive	Likely tyrosinase positive; enzyme present, with reduced melanin production. Eyes dark "Burgundy" color	Type C Singapore	Hill, M 1973 (*Breeder Documented*). Charlton, A 2002 (*Breeder Documented*).		
49	**Albino Bar**	Body - Color / Pattern	barbar aa		Double Recessive	Produced by combination of: Bar (Bar) + Albino (aa)				
50	**Albino Blau (Super Blau)**	Body - Color / Pattern	rr aa or AbAb aa or Abab aa		Double Recessive	Produced by combination of: European Blau + Albino (rr aa) or Asian Blau + Albino (AbAb aa or Abab aa).	Super Blau	Dzwillo 1959, rr aa.		
51	**Albino Blond (Super Blond)**	Body - Color / Pattern	aa bb		Double Recessive	Produced by combination of: Blond (bb) + Albino (aa)	Super Blond	Haskins & Haskins 1948, referenced in breeding tests only. Bias 2016 (*pending*)		
52	**Albino Cream (Super Cream)**	Body - Color / Pattern	bb gg aa		Triple Recessive	Produced by combination of: Blond + Golden + Albino (bb gg aa).	Super Cream			
53	**Albino Golden (Super Golden)**	Body - Color / Pattern	aa gg		Double Recessive	Produced by combination of: Golden (gg) + Albino (aa)	Super Golden			
54	**Albino Silver (Super Silver)**	Body - Color / Pattern	rr gg aa or AbAb gg aa or Abab gg aa		Triple Recessive	Produced by combination of: European Blau + Golden + Albino (rr gg aa) or Asian Blau + Golden + Albino (AbAb gg aa) or Abab gg aa).	Super Silver			
55	**Albino White (Super White)**	Body - Color / Pattern	bb rr aa, or bb Abab aa	(a or Lu) + (r or r2) + b	Autosomal Recessive (Triple)	Produced by combination of either: Blond (bb) + European Blau (rr) + Albino (aa), or Blond (bb) + Asian Blau (Abab) + Albino (aa). Some melanophore expression with Lu vs. a form of albino. Body coloration pale, Reflective qualities remain, while color pigment removed.	Super White			
56	**Albino Zebrinus**	Body - Color / Pattern	Zeze aa		Autosomal Recessive	Produced by combination of: Zebrinus (Ze) + Albino (aa)				

	A	B	C	D	E	F	G	H	I	J
57	**Asian Neon (Neon Trait)**	Body - Color / Pattern		An	X + Autosomal	Not to be confused with Neon Tail. Co-expression of X-linked NiII body + Leucophore White fins in linked, unbreakable complex. Can be combined with ebeb or Abab to remove specific xantho-erythophores in finnage and body.	See: Neon Trait (Asian Neon), Neon Tail (Blue), Neon Tail (Red), Neon Tux (Blue or Green)	Bias 2014, *unpublished correspondance w/Yuji Yamaguti*.		
58	**Bar**	Body - Color / Pattern	bar		Autosomal Recessive	3-5 vertical bars, irridophore based stripes with "gaps" populated by melanophores. Similar to X-linked Tigrinus, expressing straight & forked bars. barbar (homo), Bar/bar (hete), BarBar (non-Bar). Variable expressivity determined		Phang & Khoo 1999		
59	**Black Caudal Peduncle**	Body - Color / Pattern	Bcp	Bt	X / Y	Black caudal color pattern gene, X and Y linked, showed single gene inheritance and dominant expression in both sexes. Utilized NiII HB Red strain to test linkage of caudal color ornaments.	Half Black, Half Tux. See: Nigrocaudatus, Black Tail.	Khoo & Phang 1999		
60	**Blond**	Body - Color / Pattern	b		Autosomal Recessive	Production of near normal amount of dendritic, corolla and punctate melanophores in reduced size with modified structure as compared to grey wild-type. Alters size of melanophores. bb (homo), Bb (hete) and BB (non-blond).	Gold (USA & Asian), Blond (Europe)	Goodrich 1944		
61	**Blue (Flourescent Chromatophore)**	Body - Color / Pattern			Genetic Polymorhism	Located by researcher in one albino strain, no non-abino. With focal shift, alternate interpretation can be made that Nakajima's structure [dendritic "bluish-white" chromatophore] is interspersed visible blue iridophores lying		Nakajima 1999		
62	**Blue 1 (European Blau)**	Body - Color / Pattern	r	r1 or eb	Autosomal Recessive	Homozygous removal of red & yellow in body. Reduced red present in finnage. Ectopic melanophores removed, basal melanophores reduced. Snakeskin pattern degrades. Reflection reduced. rr (homo), RR (non-blau), and Rr (hete).	European blau	Aida 1921 (r = *medaka yellow cell mutation*), Dzwillo 1959		
63	**Blue 2 (Asian Blau)**	Body - Color / Pattern	Ab	r2 or Rr	Autosomal Dominant	Heterozygous suppression of erythrophores (red). Homozygous suppression xantho-erythrophores (yellow-red), finnage reduction. Two distinct melanophore modification in heterozygous vs homozygous AbAb (homo), Abab (hete) and	Asian blau	Shaddock 2009, *referenced & declared as (Ab). No supt data.*		
64	**Blue 3 (Hellblau)**	Body - Color / Pattern		r3	Autosomal Recessive	Homozygous removal of red color pigment, partial removal of yellow. Unlike Asian & European Blau snakeskin pattern does not degrade. Reflective qualities increased. r3r3 (homo), R3R3 (non-blau), and R3r3 (hete).	Hellblau			
65	**Blue Diamond (Luster)**	Body - Color / Pattern		Bd	X / Y	Proliferation of blue iridophores, producing a "metallic light blue sheen" over the entire body. Likely subject to X & Y crossover.	Luster	Khoo & Phang 2007		
66	**Bunt**	Body - Color / Pattern			X or Autosomal "Unknown"	Wild-Type orange color pigment over and between iridophore pattern on body. Similar expression as Japanese Sunset (Orange Body Color) and Ginga Rubra.	See: Sunset Mosaic, Rubra, Anterior Rubra.			
67	**Buxeus (Schimmelpennig Platinum)**	Body - Color / Pattern			Y / X	Silver-Blue iridophore shoulder pattern with Metal Gold (Mg) overlay. Likely Full Body modifier. Linked in complex with Ds. Originated out of Vienna Emerald Green Ds.	Schimmelpennig Platinum, Schim Plat, Buxeus.	Kempkes 2006		
68	**Caeruleus (Japan Blue)**	Body - Color / Pattern	Ca	Jb or A	X / Y	Most commonly Y-linked. 1/2 body reflective blue iridophore pattern.	Japan Blue, Aquamarine. See: Half Body Pattern.	Kempkes 2007		
69	**Calico**	Body - Color / Pattern			Autosomal "Unknown"	Blue iridophore & melanophore pattern characterized by a series of "blue patches". Full body modification as evidenced by pattern scattered whole body & finnage. Examples seem associated with or result of "blau" mutation. Possible	See: Singapore Blue, Turquoise			

	A	B	C	D	E	F	G	H	I	J
70	**Coral Red**	Body - Color / Pattern		Co	Y	Red color pigment shoulder pattern. Linked in complex with Ds. Likely Full Body modifier. Originated out of Vienna Emerald Green Ds.	Neon (Europe)			
71	**Cream**	Body - Color / Pattern	bb gg		Autosomal Recessive (Double)	Produced by the action of two genes (bbgg). Melanophores are reduced by >80-90%. Corolla & Punctate same size as blond. Dendritic smaller than b or g. Reduced viability.		Goodrich 1944		
72	**Emerald Green Iridescent**	Body - Color / Pattern		EGI	X / Y	Green color at base of caudal / peduncle juncture. Comprised of blue iridophores and Metal Gold &/or Yellow color pigment. Solid blue variant. Likely full body modifier that produces green sheen in Vienna Emerald.	See: Emerald Green Iridescent (EGI), Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika (Me), Vienna Emerald Green (VEG)			
73	**Extension (Spotting)**	Body - Color / Pattern				Series of melanophore spots modified into a single pattern (co)-expression. Examples to include Santa Maria and Saddleback. Visual distinction in melanophore type under magnifications.		Bias 2013, *unpublished data*		
74	**Filigran**	Body - Color / Pattern	Fil		X / Y	Iridophore & melanophore based pattern in caudal and peduncle. Ocular spotting in caudal express xanthophores (yellow color pigment &/or Mg). Dzwillo determined Fil to be Y-linked, now known to crossover.	See: Variegation, Leopard, Grass, Snakeskin Tail, Filigran.	Dzwillo 1959		
75	**Fredlini**	Body - Color / Pattern	fr		Autosomal Recessive	First officially described by Haskins & Druzba 1938 [Fredlini (fr)]. Goodrich 1944 [Golden (g)]. H&D later deferred to Haskins naming. ***Note:*** *See Golden* . frfr (homo), Frfr (hete) and FrFr (non-Fredlini).	Tiger (Asia), Golden (USA), Fredlini (Europe)	Haskins & Druzba 1938 [Fredlini (fr)], Goodrich 1944 [Golden (g)]		
76	**Full Red**	Body - Color / Pattern			X / Y / Autosomal	Full red body and finnage. Comprised of multiple X-linked, Y-linked and autosomal modifying genes. Each coloring specific zones of regulation.				
77	**Glass Belly**	Body - Color / Pattern		gb	Autosomal Recessive	Homozygous reduction of iridiphores & leucophores. Results in a "matt finish". Dark eyes or body with visible melanophores. Ventrum rendered transparent. No effect blue irids in finnage, and body in specific phenotypes. gbgb (homo), Gbgg (hete) and GbGb (non-Glass Belly).		Shaddock 2009, (*unpublished)* .		
78	**Golden**	Body - Color / Pattern	g		Autosomal Recessive	Reduced amount of dendritic, corolla & punctate melanophores. Size of dendritic & corolla greatly increased and collected on scale edges. Suppressor of melanophore populations. Studies based on Domestic stock, not wild. gg	Tiger (Asia), Golden (USA), Fredlini (Europe)	Haskins & Druzba 1938 [Fredlini (fr)], Goodrich 1944 [Golden (g)]		
79	**Grey**	Body - Color / Pattern			Dominant	Grey Reticulation as result of corolla & dendritic melanophores. This is "normal wild-type" condition found in nature.				
80	**Half Body Pattern**	Body - Color / Pattern			X / Y / Autosomal	Likely precursor for any color pigment or iridophore based 1/2 body color pattern expression; translucent expression. While most are defined as sex-linked, there is suggestive argument for color variation by linked autosomal & sex-linked.	Half Black, Japan Blue, MBAG			
81	**Half Red**	Body - Color / Pattern			X	Often associated with 2 black spot (one in peduncel & second in caudal) + Old Fashioned Shoulder Stripe; "ear tag)	Half Red or Neutral Red. See Half Body Pattern			
82	**Heteromorpha**	Body - Color / Pattern			X / Y	Motile melanophore pattern starting on anterior shoulder along & below lateral line. Extending posterior to caudal / peduncle juncture with variation. Common in Grass strains.	Nike Stripe, Moscow (Mw).			

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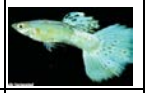
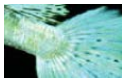
83	**Ivory**	Body - Color / Pattern		I	Autosomal Dominant	Heterozygous suppression of erythrophores (red). Homozygous suppression xantho-erythrophores (yellow-red), with finnage reduction. Distinct melanophore modifications in heterozygous vs homozygous states. Resulting in a "white"		Tsutsui, Y 199? (Breeder documented)		
84	**Jade Variegated**	Body - Color / Pattern				Metallic green expression of Green Tail. Green = blue irids + Mg. Blau variant; either European or Asian Blau. [rr (homo) or Abab (hete)].	See: Neon (Green), Green Tail	Khoo & Phang 2007		
85	**Lazuli**	Body - Color / Pattern		Lz	Y	Anterior shoulder blue iridophore pattern. Considered by Japanese breeders to be part of Caeruleus (Japan Blue) trait with additional anterior coloration. Europeans consider likely origin from Coral Red.	See: Turquoise			
86	**Leopard Body**	Body - Color / Pattern			X / Y	Co-expression of Ni + SSb + SSt in body and finnage. Suggestive of being homozygous on either X or Y. Expected X & Y co-expression of Ni + SSb + SSt is modification of Var in caudal from linear to circular. Similar to Leopard Tail.	See: Leopard Tail.			
87	**Leucophore White (White Neon)**	Body - Color / Pattern		Le	X or Autosomal "Unknown"	Presence of white leucophores in finnage. Either stand-alone, partially masked underlying xantho-erythophore (yellow-red) color pigment cells, or overlaying melanophores &/or iridophores. Not in complex with NilI; Asian Neon.				
88	**Magenta**	Body - Color / Pattern		M	Autosomal Dominant	Proliferation of red color pigment and iridophores. Converts yellow color pigment cells to red, though Metal Gold (Mg) may remain. Concentrates black melanophores. Finnage reduction.				
89	**Material Gene (Japan)**	Body - Color / Pattern		Mg	Autosomal	In conversation with Japanese and Asian breeders "Material" refers to higly reflective qualities of phenotypes expressing homozygous Metal Gold (Mg) in conjunction with yellow color pigment. Not limited to "Micariff"phenotypes. MgMg (homo), Mgmg (hete) and mgmg (non-Metal Gold).	Metal Gold (Mg). See Metal Gold.	Bias 2016, (*unpublished conversations with Asian Breeders)*		
90	**Metal Gold**	Body - Color / Pattern		Mg	Autosomal Dominant ***(not-confirmed)***	Yellow-Gold iridophore trait. Homozygous expression visible in females. Heterozygous expression in males portions of finnage & body. Homozygous expression in males creates an overall “metallic sheen”. MgMg (homo), Mgmg (hete) and mgmg (non-Metal Gold).	Material Gene (Asia), Metallic (Europe)			
91	**Metallicus (Stoerzbach)**	Body - Color / Pattern	me	s	Autosomal Recessive	Blue iridophore gene. Removal of red & yellow color pigments in body, but not finnage. Individuals with a Yellow-Gold cast result from addition of Metal Gold (Mg). Originated out of Vienna Emerald Green Ds. meme (homo), Meme	Stoerzbach (USA), Störzbach Metal (Europe)	Kempkes 2007		
92	**Metarika (Reflective Dorsal Spot)**	Body - Color / Pattern			Y	Similar in color & pattern to Iridescence (Ir). With addition of "Reflective Dorsal Spot" below dorsal juncture. Presence of bright green colored patches.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,			
93	**Micariff White (McWhite)**	Body - Color / Pattern		Mcw	X or Autosomal "Unknown"	White leucophore pattern running the length of body. Can be partially masked by other traits above lateral line. Often lacks Viridis (Vir) blue-green iridophore pattern. Result of White Belly + a full body modifier.	See: White Belly.			
94	**Midnight - black**	Body - Color / Pattern		Mid	Autosomal	Hypermelaninization, “non-motile” black melanophores. Common in Black Moscow strains, can be infused into non-Moscow phenotypes. Visible in females. Reports of expression in F1, suggestive of Autosomal Dominance.	Onyx or Midnight Black.			
95	**Moscow**	Body - Color / Pattern	Mw		Y	Blue iridophore shoulder pattern. Likely Full Body modifier. Color variation; addition or removal of xantho-erythophores.				

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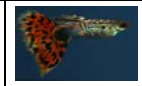
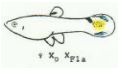
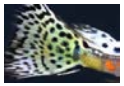
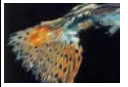
96	**Moscow Blau Additional Gene**	Body - Color / Pattern		MBAg	X	1/2 body pattern expressing motile black mediating moderate & translucent melanin development over entire body area posterior to dorsal fin, and in caudal peduncle. Other colour patterns may be nearly or wholly obscured.	See: Half Body Pattern			
97	**Neon Tail (Blue)**	Body - Color / Pattern	Ln		X / Autosomal	Metallic turquoise tail & bcp, is postulated to be produced through interactions of 3 genes; i.e. Ln (light turquoise blue), Blt (navy blue tail), Rdt (red tail). [rr (homo) or Abab (hete)].	See: Neon Trait (Asian Neon), Neon Tail (Blue), Neon Tail (Red), Neon Tux (Blue or Green)	Khoo & Phang 2007, *postulated only*		
98	**Neon Tail (Green)**	Body - Color / Pattern	Gn		X / Autosomal	Metallic [Green] turquoise tail & bcp, is postulated to be produced through interactions of 3 genes; i.e. Ln (light turquoise blue), Blt (navy blue tail), Rdt (red tail). Green = blue irids + Mg. [rr (homo) or Abab (hete)].	See: Neon Trait (Asian Neon), Neon Tail (Blue), Neon Tail (Red), Neon Tux (Blue or Green), Jade Variegated	Phang & Fernando 1991, Khoo & Phang 2007, *postulated only* .		
99	**Neon Tux (Blue or Green)**	Body - Color / Pattern			X + Autosomal	Metallic turquoise tail & bcp, is postulated to be produced by interactions of 4 genes; i.e. Ln (light turquoise blue), Blt (navy blue tail), Rdt (red tail) & Bcp (black caudal peduncle). Green = blue irids + Mg. [rr (homo) or Abab (hete)]	See: Neon Trait (Asian Neon), Neon Tail (Blue), Neon Tail (Red), Neon Tux (Blue or Green)	Khoo & Phang 2007, *postulated only*		
100	**Nigrocaudatus I**	Body - Color / Pattern	NiI		X	1/2 body melanophores on caudal peduncle and central area of caudal fin. Defined as sex-linked. Full body modifier. In outcross, F1 lost partial coloration.	See: Half Body Pattern	Nybelin 1947		
101	**Nigrocaudautus II**	Body - Color / Pattern	NiII		X / Y	Melanophores on [1/2 to] 2/3 body, caudal peduncle and central caudal fin. Visible prebirth, corollar shape. Sex-linked. Some breeding's suggestive of an autosomal form, with added sex-linked melanophores. Full body modifier,	See: Half Body Pattern	Dzwillo 1959, Nayudu 1979		
102	**Old Fashioned Stripe (Ear Tag)**	Body - Color / Pattern			X	Red color pigment over iridophore stripe on anterior shoulder.	Ear Tag	Boutot (Breeder documented)		
103	**Pink**	Body - Color / Pattern	p	pk or p	Autosomal Recessive	Removal of red in body and a “yellow-orange” cast in finnage. Homozygous Pink reduction of NiII melanophores & increase in MBAG. Removes blue iridophores. Reduces in size and finnage. pkpk or pp (homo), Pkpk or Pp (hete) and PkPk or		Luckman 1990 (*Breeder documented)* , Foerster 1993, Kempkes 2007		
104	**Pink White**	Body - Color / Pattern		APW or Pw	Y	Profusion of leucophore pattern caudal / peduncle base. Subject to positive selection &/or amplification in co-expression w/full body traits; Variable expressivity. Suggestion of X-linked.	American Pink White, White Tail			
105	**Platina**	Body - Color / Pattern			X / Y / Autosomal	Breeder term for isolated pigmentation of scales along topline, caudal / peduncle juncture; white, red, blue, yellow. Normally associated with a full body trait such as Asian Neon.				
106	**Purple Body (female expression)**	Body - Color / Pattern	*Pending*		*Pending*	*Pending*	*Pending*	*Pending*		
107	**Purple Body (male expression)**	Body - Color / Pattern	*Pending*		*Pending*	*Pending*	*Pending*	*Pending*		
108	**Saddleback**	Body - Color / Pattern		Ht	Y	Melanophore band upper peduncle quadrant, anterior of dorsal base & running to caudal-peduncle juncture. Yellow color pigment lower peduncle quadrant (Y-linkeded). Version lacking yellow pigment (Stratum).	Half Tuxedo, Half Tux. See Stratum.			

	A	B	C	D	E	F	G	H	I	J
109	**Santa Maria**	Body - Color / Pattern		Sm	Y	Reported X-linked allele. Solid Melanophore band upper peduncle quadrant, posterior of gill plate & running to caudal-peduncle juncture. Variable expressivity suggestive of extension.				
110	**See-Thru**	Body - Color / Pattern	aa Abab gbgb		Autosomal Recessive (Triple)	Produced by the action of three genes: Albino (aa) + Asian blau (Abab) + Glass Belly (gbgb). Mutations remove melanophores, xantho-erythopores and certain iridophores & leucophores from skin.		Shaddock 2009		
111	**Silver**	Body - Color / Pattern	rr gg, or Abab gg		Autosomal Recessive (Double)	Produced by the action of two genes; European Blau (r) + Golden (gg) or Asian Blau (Ab) + Golden (gg). Pale body coloration. Removal of red & yellow color. Finnage flatter colored. Scales edged in black. Irids & Mg present.		Luckman (Breeder documented)		
112	**Silverado**	Body - Color / Pattern			Y	Leucophore shoulder trait from P. reticulata wingei infusion. Likely full body amplification qualities similar to other Y-linked shoulder pattern.				
113	**Singapore Blue (Singa)**	Body - Color / Pattern			Y	Mutation on Japan Blue. First arose in Singapore stocks. Shade of blue, like expression of iridophore reflective qualities, is slight reduced.	Singa Blue			
114	**Smaragd Iridescens**	Body - Color / Pattern	SmIr		Y	Females hyaline dorsal, males basal portion has a red speck with pale black border. Red and black in body. Metallic-green sheen on body; Dzwillo apparently did not think this sheen product of Ir. Rather product of EGI.	See: EGI, Iridescens, Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot, Reflective Dorsal Spot, Vienna	Dzwillo 1959 (Smaragd Ir)		
115	**Snakeskin Body**	Body - Color / Pattern	Ssb		X / Y	Chain like pattern of irridophore based stripes with "gaps" populated by melanophores.		Phan 1989 1990 , Khoo & Phan 2007		
116	**Stratum**	Body - Color / Pattern			X or Autosomal "Unknown"	Motile melanophore band upper peduncle quadrant, posterior of dorsal base & running to caudal-peduncle juncture. Commonly co-expressed in Sc and Ssb. Collected 2007 Kempkes/Poeser wild Surinam Paramaribo.	Saddleback-Filigran, Saddleback-Schim Plat. See: Saddleback			
117	**Sunset Mosaic**	Body - Color / Pattern			X or Autosomal "Unknown"	Wild-Type orange color pigment over and between iridophore pattern on body. First associated with Mosaic's in Japan. Similar expression as German Bunt (Multi-Color).	See: Bunt			
118	**Tanaka Rubra**	Body - Color / Pattern			X-linked or Autosomal "Unknown"	Two forms of Expression; 1. Red pigment overlaying circular or linear iridophore pattern. 2. Red between iridophores and over melanophores.	Rubra, Rubra, Ruber, Tanaka Ginga Rubra (over Ze). See: Rubra, Bunt.			
119	**Turquiose**	Body - Color / Pattern		T		Anterior shoulder blue-green iridophore pattern. Green from addition of xantophores. Considered by Japanese breeders to be part of Caeruleus (Japan Blue) with additional anterior coloration. Europeans consider likely origin from Coral Red.	See: Calico			
120	**Vienna Emerald Green**	Body - Color / Pattern		VEG	Y	Multiple genes; predominantly Y-linkeded with X-linked & autosomal modifying genes. Metallic green color (EGI), Metal Gold in body (Mg), yellow pigment in finnage, black eye spots, peduncle barring producing "meandering" form.	See: Emerald Green Iridescent (EGI), Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika (Me), Vienna Emerald Green (VEG)			
121	**Violet**	Body - Color / Pattern		Ab + Pb	Autosomal Dominant (Double Dominant)	Product of two autosomal dominant traits; Asian Blue (Abab) + Purple Body (***Pending***). Variable expressivity zygosity dependant.	See: Purple Body, Asian Blau.			
122	**White**	Body - Color / Pattern	rr bb		Autosomal Recessive (Double)	Produced by the action of two genes (rrbb). Melanophore size & numbers reduced. Body coloration pale,some pattern remains subject to limitations of r. Finnage is flatter colored.		Dzwillo 1959		

	A	B	C	D	E	F	G	H	I	J
123	**White Belly**	Body - Color / Pattern				White leucophore belly. Frequently lacks Viridis (Vir) blue-green iridophore pattern.	See: McWhite.			
124	**White Saddle**	Body - Color / Pattern		Ws	X / Y	Upper peduncle quadrant populated in white leucophores.				
125	**Black Tail**	Finnage - Color / Pattern	Bt		X	Dark Black melanophore based caudal ornament. No color pigment.	See: Black Caudal Peduncle	Khoo & Phang 2007		
126	**Blue Tail**	Finnage - Color / Pattern	Blt		X	Dark Navy Blue melanophore & iridophores based caudal ornament. No color pigment, though often in co-expression with Metal Gold (Mg). Blau variants; presence of European or Asian Blau apparent in some.	Blue Snakeskin, Blue Delta.	Phang & Fernando 1991, Khoo & Phang 2007		
127	**Flavus**	Finnage - Color / Pattern	Fla or Fl		X / Y Dominant	Extensive melanophores (black) on edges of caudal and (xanthophores (yellow) in caudal fin. Primarily dendrites. Weak effect female pigmentation. Visible 2 wks after birth. Discovered in "Domestic" stocks. Homozygous reduction	Homozygous Fla suppresses action of: Cp, NiII, Ir, Ds, Ch.	Winge & Ditlevsen 1947, Dzwillo 1959, Schröder 1970 1976, Kirpichnikov 1981		
128	**Grass**	Finnage - Color / Pattern		Gra	X / Y	Variegation; Fine "dot" circular pattern. Blue Grass adds Asian Blau. Strawberry Grass adds Purple Body. Yellow Grass adds xanthophores. Violet Grass adds Asian Blau + Purple Body.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.			
129	**Green Tail**	Finnage - Color / Pattern	Grt		X	Co-expression of blue iridophores + xanthophores	Caudal Pigmentation	Phang & Fernando 1991, Khoo & Phang 2007		
130	**Leopard Tail (NiII)**	Finnage - Color / Pattern			X / Y / Autosomal	Variegation; Example of similar phenotypes created by diverse genotype. Co-expression of melanophores + xanthophores + Ni + SSb + SSt over white leucophores. Generally, modification of Var from linear to circular.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.			
131	**Leopard Tail (non-NiII)**	Finnage - Color / Pattern			X / Y / Autosomal	Variegation; Example of similar phenotypes created by diverse genotype. Co-expression of melanophores + xanthophores + Mo over white leucophores. Generally, modification of Var from linear to circular.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.			
132	**Mosaic**	Finnage - Color / Pattern		Mo	X / Y	Variegation; Circular spotted pattern in caudal finnage. Not linked to Variegation in dorsal. Similar to Leopard, normally assoc. with red color pigment & white leucophores.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.	Khoo & Phang 1999, in reference.		
133	**Pigmentierte Caudalis**	Finnage - Color / Pattern	Cp		X / Y Dominant	Melanophores on edges of tail fin and along centre of tail fin. Visible 1 month after birth. Primarily corollar type, bipolar to lessor degree. Studies suggestive of Cp comprised of two closely linked melanophore gene in regard to development.	Caudal Pigmentation	Dzwillo 1959, Nayudu 1979		
134	**Red tail**	Finnage - Color / Pattern	Rdt		X / Y	Color Pattern gene, X and Y linked, showed single gene inheritance and dominant expression in both sexes.		Khoo & Phang 1999		
135	**Snakeskin Tail**	Finnage - Color / Pattern	Sst		X / Y	Variegation; Chain like pattern of irridophore based stripes with "gaps" populated by melanophores.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.	Phan 1989 1990 , Khoo & Phan 2007		
136	**Variegation**	Finnage - Color / Pattern	Var		X / Y Dominant	Inheritance of variegated tail patterns appears to be determined by a single locus on the X and Y chromosomes. Var is epistatic to wild-type [Oval Tail]. Tightly linked to Snakeskin Body & Tail.	See: Variegation, Mosaic, Leopard, Grass, Snakeskin Tail, Filigran.	Khoo & Phang 1999		

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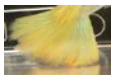
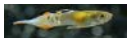
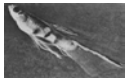
137	**White Tail**	Finnage - Color / Pattern		Wt	X / Y	Profusion of leucophore pattern caudal / peduncle base. Subject to positive selection &/or amplification in co-expression with full body traits; variation.	See: Pink White			
138	**Yellow Tail**	Finnage - Color / Pattern		Yt	X / Y and Autosomal	Co-expression of xanthophores (sex-linked yellow color pigment + autosomal Mg) over white leucophores.				
139	**Big Ear**	Finnage - Shape			X	Wide Semi-Circular pectoral fins extending sharply from base on straight plain with convex angle, coming to end at body juncture. Variation in extension (width). Heavy black melanophore pigmentation. Most often in assoc. with NiII.	Dumbo			
140	**Bottom Sword**	Finnage - Shape	Bs	Ls	X / Y / X+Y	Prolongation of rays 11-14 on the ventral edge of homocercal caudal. Homocercal caudal with extension.	Lower Sword	Hildemann 1951		
141	**Delta Tail**	Finnage - Shape			X / Y / Autosomal	Phenotype originally XCp + YDs. As a result of crossover now found in various combinations. Responds to "positive selection" & linebreeding; autosomal modifying genes. Homocercal caudal with extension.				
142	**Double Sword**	Finnage - Shape		Ds	X / Y / X+Y	Prolongation of rays 8-10 and rays 14-16. Product of both X and Y linked genes, and likely autosomal modifying genes. Homocercal caudal with extension.		Hildemann 1951, Dzwillo 1959		
143	**Double Sword (Asian X-linked + extension)**	Finnage - Shape			X	X-linked Ds + yellow-white- red cologr pigment in linked complex. Homocercal caudal with extension.				
144	**Double Sword (Asian X-linked + red color pigment)**	Finnage - Shape			X	X-linked Ds + red color pigment in linked complex. Homocercal caudal with no extension.				
145	**Double Sword (Asian X-linked + yellow color pigment)**	Finnage - Shape			X	X-linked Ds + yellow-white color pigment in linked complex. Homocercal caudal with no extension.				
146	**Double Tail**	Finnage - Shape			Autosomal "Unknown"	Produced by additional skin between ray extensions. Results in a "wrinkled overlapping" appearance of both caudal and dorsal. Likely full body trait as both caudal and dorsal are modified. Variation suggestive of autosomal linkage.				
147	**Elongated Dorsal**	Finnage - Shape	Fa	Eld	X / Autosomal	Extension of dorsal finnage in both sexes. Type 1 expression in both sexes. Type 2 expression in males only. Variation in both zygosity dependant.		Kirpichnikov 1981, referenced		
148	**Fan Tail**	Finnage - Shape		Fa	X / Y / Autosomal "Unknown"	Produced by Lt or Ds + Cp, and autosomal modifying genes. As a result of crossover now found in various combinations. Responds to "positive selection" & linebreeding. Homocercal caudal with extension.	Fächer Tail			
149	**Flag Dorsal**	Finnage - Shape		Fa	X / Y	Long parallelogram dorsal rising sharply from dorsal base, coming to a vertical end with variation in extension (length). Non-tapering in shape. Non-Semi-Circular in shape.				
150	**Flag Tail**	Finnage - Shape		Fa	X / Y / Autosomal "Unknown"	Often produced from Lt + Cp. Incorporation of full body iridophore traits such as Stoerzbach &/or Metal Gold traits such as Schim Plat can enhance optimum tail shape. Homocercal caudal with extension.	Scarf Tail, Super Flag (Double recessive)			

	A	B	C	D	E	F	G	H	I	J
151	**Gull Wing**	Finnage - Shape			Autosomal Dominant	Extended pectoral finnage with variegation. Corresponding extended ventral finnage. Japanese breeders are not sure if distinct from Sunset trait.	See: Sunset (Japanese)			
152	**Half Moon Caudal**	Finnage - Shape		Hm	X	Crescent shape caudal with first upper and lower ray extensions protruding at 180* angle. Most often seen with Hi-Fin Dorsal. Shorter body:cuadal ratios common. Homocercal caudal with extension.				
153	**Hi-Fin Dorsal**	Finnage - Shape		Fa / Eld	Autosomal "Unknown"	High Semi-Circular dorsal rising sharply from dorsal base at convex angle, coming to a vertical end with variation in extension (height). Non-parallelogram in shape. Non-tapering in shape.	Hi-Fin Dorsal, Elongated Dorsal, Hi-Top Dorsal, Half Thumb Dorsal, Big Dorsal.			
154	**Kalymma**	Finnage - Shape	Kal		Autosomal Dominant	Elongation of finnage in both sexes. Requires co-expression with homozygous autosomal recessive sup (= Sup+) in homozygous expression, thus Kal Kal or Kal kal and sup sup. Dominant allele of Sup inhibits action of Kal. Individuals Kal_ SupSup & Kal_ Supsup are normal.		Schröder 1969c, Kirpichnikov 1981, referenced		
155	**Lyre Tail**	Finnage - Shape		Lt		Prolongation of rays 8-10 and rays 14-16. Product of both X and Y linked genes, and likely autosomal modifying genes. Tips flare outward on ends. Homocercal caudal with extension.				
156	**Merah**	Finnage - Shape		Me	Autosomal Dominant	Removal of loose connective tissue between dermal bones (hemi-rays) of dorsal / caudal. Any fin type. Occasional gonopodium modification. Variation in ray expression; zygosity dependant. Homocercal caudal with extension. MeMe (homo), Meme (hete) and meme (non-Meah).	Crowntail			
157	**Pin Tail**	Finnage - Shape		Pt	X / Y / Autosomal "Unknown"	Linear prolongation of several central rays extending from trailing edge of homocercal caudal ending in a point. Can be found in co-expression with Rndt, Lt or Ds. Co-expression determined by degree of ray fusion in center of extension.	Needle Tail			
158	**Ribbon Fin**	Finnage - Shape		Rib	Autosomal Dominant	Prolongation of ventral finnage in both sexes. Rib/Rib (homo), Rib/rib (hete), rib/rib (non-Ribbon). Variation with zygosity; three types (length) of extension.	Giessen, Berlin Guppy, Ribbon Fin. See: Swallow.	Schröder 1969c, Kirpichnikov 1981, referenced		
159	**Robson**	Finnage - Shape			X & Autosomal	Homocercal roundtail with tapering dorsal. Pigmentation males and female fins. Homocercal caudal shape.		Robson, A.E. 1937 (Breeder documented)		
160	**Round Tail**	Finnage - Shape		Rndt	X / Y	25-27 fin rays of all (complete) tail shapes in males & females. Upper and lower 5-7 are shorter and unbranched in wild-type. Multiple branching in central rays. Homocercal shape.	See Oval: Tail.			
161	**Spade Tail**	Finnage - Shape		Spt	X / Y	Modification of shape into a "spade-like" protrusion. Homocercal caudal shape.				
162	**Spear Tail**	Finnage - Shape		Sp	X and Autosomal "Unknown"	Linear prolongation of multiple central rays extending from trailing edge of homocercal caudal ending in a point. Can be found in co-expression with Rndt, Lt or Ds. Co-expression determined by degree of ray fusion in center of extension.		Hildemann 1951		
163	**Sunburst**	Finnage - Shape			Autosomal "Unknown"	Hemi-ray bifurcation & structure modified in caudal & dorsal. Suggestive of full body modifier. Poor ray fusion on trailing edge. Commonly involves xantho-erythophores & melanophore coloration. Variation suggestive of autosomal.				

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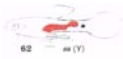
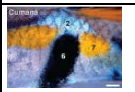
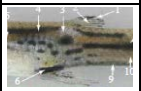
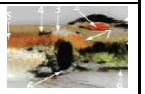
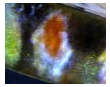
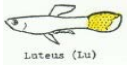
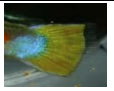
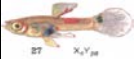
164	**Sunset (Japanese)**	Finnage - Shape			Autosomal Dominant	Extended pectoral finnage with variegation. Corresponding extended ventral finnage. Japanese breeders are not sure if distinct from Gull Wing trait.	See: Gull Wing.			
165	**Suppressor**	Finnage - Shape	Sup		Autosomal	All fins, Both sexes. Manifestation of Kal requires presence of unlinked Suppressor. Dominant allele of Sup inhibits action of Kal. KalKal SupSup and KalKal SupSup+ are normal.		Schröder 1969c, Kirpichnikov 1981, referenced		
166	**Swallow**	Finnage - Shape	kal		Autosomal Dominant	Elongation of finnage in both sexes. Requires co-expression with homozygous autosoml recessive sup (= Sup+) in homozygous expression, thus Kal Kal or Kal kal and sup sup. Dominant allele of Sup inhibits action of Kal. Individuals Kal_ SupSup & Kal_ Supsup are normal.	See: Ribbon Fin.			
167	**Tapering Dorsal**	Finnage - Shape			X / Y	Long dorsal rising sharply from dorsal base, coming to a well defined point with variation in extension(length). Non-parallelogram in shape. Non-Semi-Circular in shape.				
168	**Top Sword**	Finnage - Shape	Ts		X / Y / X+Y	Prolongation of rays 8-10 on the dorsal edge. Homocercal caudal with extension.	Upper Sword	Hildemann 1951		
169	**Veil Tail**	Finnage - Shape			X / Y / Autosomal "Unknown"	Produced by Lt or Ds + Cp, autosomal modifying genes. As a result of crossover now found in various combinations. Responds to "positive selection" & linebreeding; autosomal modifying genes. Homocercal caudal with extension.	For USA Veil Tail, See: Fan Tail.			
170	**Anterior Rubra**	Wild-Type Research	ar		Y	Color Character. Further sudivision of Winge's Ir by Blacher. Y-linked & allelomorphic to ru complex.		Blacher 1927, 1928		
171	**Armatus**	Wild-Type Research	Ar		Y	Color Character and form of caudal fin. Long, dagger-shaped, sulphur-colored prolongation of the lower edge of the caudal fin. Considered homozygous YY lethal.		Winge 1927, Blacher 1927 1928		
172	**Aureus**	Wild-Type Research	Au		Y	Color Character and form of caudal fin. Bright yellow coloring in the lower, but more especially in the upper part of caudal fin, which is often black.		Winge 1927		
173	**Autosomal Sex Determination**	Wild-Type Research			Autosomal "Unknown"	Winge postulated that autosomally distributed sex-determining genes function importantly in *[reticulta]* conjunction with those linked to the sex chromsomes. Proven (Haskins 1970) by breedings with supergenes. Autosomal sex determining genes do not normally "over-power" sex chromosomes. In out-cross F1 returned to "normal" sex determining mechanisms.		Winge 1922b 1934, Winge & Ditlevsen 1938, Haskins 1970		
174	**Bimaculatus**	Wild-Type Research			Y	Color Character. Further sudivision of Winge's Ir by Blacher. Y-linkeded and allelomorphic to ru complex.		Blacher 1927		
175	**Bipunctatus**	Wild-Type Research	Bp		Y	Color Character. Two primary orange spots below lateral line.		Natali & Natali 1931 (in Kirpichnikov 1981)		
176	**Black Area**	Wild-Type Research			Y	Quantatative means of measuring melanophore spots in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		

	A	B	C	D	E	F	G	H	I	J
177	**Black Peduncle (female)**	Wild-Type Research	Bl		X	Black trait mediating heavy melanin development over entire body area posterior to dorsal fin, and in caudal peduncle. Males are so darkened by this melanin overlay that other colour patterns may be nearly or wholly obscured.	Half Black. See: Nigrocaudautus (NiII).	Haskins 1970, referencing Dzwillo 1959		
178	**Blue Iridescent Spot**	Wild-Type Research			Y	Comprised to two layers of irids. One in stratum spongiosum of dermis. Second in hypodermis. Melanophores in multiple locations. Prior studies… …Constitute strictly Y-linked traits.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Kottler 2013 [pub 4.27.13]		
179	**Brightness Contrast**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
180	**Caudomaculatus**	Wild-Type Research	Cm		X / Y	Color Character.		Blacher 1928		
181	**Central Blue White Spot**	Wild-Type Research			Y	Test results 2008 strictly Y-linked. 2009 QTL study referenced as, "an iridescent patch on the body of the fish". Results indicated "tight linkage with Sex locus".	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Tripathi 2008 2009		
182	**Cinnamomeus**	Wild-Type Research	Ci		X / Y	Color Character.		Winge 1927		
183	**Circular Ring**	Wild-Type Research		Cr **		Underlying layer of silver / blue iridophores beneath wild-type orange and black circular spotting. **Note: genotype descriptor added after publication.	Circular Ring Effect	Bias 2013		
184	**Coccineus**	Wild-Type Research	Co		X	Color Character, derived from Sulphureus. Dzwillo determined Co "blunted" tips of swordtails. Confirmed by Bias (unpublished data), as reduction in extension, rounded tips, poorly fused tips.		Winge 1927, Dzwillo 1959, Bias 2011-12 (unpublished data)		
185	**Color Contrast**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
186	**Color Neutral (female)**	Wild-Type Research	X_0		X_0 (color neutral)	Does not involve any color pattern of the males. The abscense of these genes on X chromosomes.	Descended from O. Winge's "Spot Race". See: Oval Tail.	Winge 1922b, Kirpichnikov 1981		
187	**Color Neutral (female)**	Wild-Type Research	X_{ch}		Xch (recessive)	Does not involve any color pattern of the males. The abscense of these genes on X chromosomes. Dzwillo denoted "Ch" as a recessive, thus should be "ch" in lower case.		Dzwillo 1959, Kirpichnikov 1981		
188	**Elongatus**	Wild-Type Research	el		X / Y	Color Character and form of caudal fin. Produces an elongation & reddish-yellow color on dorsal & caudal fin with elongated upper edge and vivid reddish-yellow coloring on upper and lower edge. Minimal extension in wild-type.		Winge 1922a 1927		
189	**Ferrugineus**	Wild-Type Research	Fe		Y	Color Character. Series of orange anterior spots with caudal pigment and ocular spotting.		Winge 1927		
190	**Fin Rays**	Wild-Type Research				25-27 fin rays of all (complete) tail shapes in males & females. Upper and lower 5-7 are shorter and unbranched in wild-type. Multiple branching in central rays.		Dzwillo 1959		

	A	B	C	D	E	F	G	H	I	J
191	**Fleck**	Wild-Type Research			X / Y	Color Character. Possibly a reference to a singular orange "circular or linear spot" in body.		Sherman, 1937 (*unpublished Thesis*)		
192	**Fuzzy Black Area**	Wild-Type Research			Y	Quantatative means of measuring melanophore spots in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
193	**Gladigerens**	Wild-Type Research	g		Y	Color Character and form of caudal fin. Further division of Winge's armatus by Blacher.		Blacher 1928		
194	**Gladigerens Modified**	Wild-Type Research	g2		Y	Color Character and form of caudal fin. Further division of Winge's armatus by Blacher.		Blacher 1928		
195	**Inornatus**	Wild-Type Research	In			Description not found. General definition; Adorned, decorated.		Kirpichnikov 1981, referenced		
196	**Iridescens I**	Wild-Type Research	Ir		Y	Color Character. Hyaline dorsal, basal portion has a red speck with pale black border. Red and black in body. Metallic-green sheen on body; Dzwillo apparently did not think this sheen product of Ir. Rather product of EGI.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Winge 1922b		
197	**Iridescens II**	Wild-Type Research	Ir		Y	Color Character with silver sheen of side of body. Further subdivision of Winge's Ir by Blacher.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Blacher 1928		
198	**Iridescent Area**	Wild-Type Research			Y	Quantatative means of measuring iridophores in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Brooks & Endler 2001		
199	**Lineatus**	Wild-Type Research	Li		X	Color Character and form of caudal fin. Red, black-edged stripe in the upper margin of the caudal fin, which is often somewhat prolonged.		Winge 1927		
200	**Lutescens**	Wild-Type Research	Ls		X / Y	Color Character; yellow peduncle spot.		Natali & Natali 1931 (in Kirpichnikov 1981)		
201	**Luteus**	Wild-Type Research	Lu		X / Y	Color Character; yellow cuadal spot.		Winge 1927		
202	**Macula caudales**	Wild-Type Research	Mc		Y	Color Character. Further sudivision of Winge's Ir by Blacher. Y-linkeded and allelomorphic to ru complex.		Blacher 1927 1928, Goodrich 1929		
203	**Macula Nigra Dorsales**	Wild-Type Research	Mnd		Y	Color Character. Further sudivision of Winge's Maculatus by Blacher.		Blacher 1927 1928, Goodrich 1929		
204	**Macula rubia**	Wild-Type Research	Mr		Y	Color Character. Further sudivision of Winge's Maculatus by Blacher.	See: Maculatus (red).	Blacher 1927 1928, Goodrich 1929		

	A	B	C	D	E	F	G	H	I	J
205	**Maculatus (black)**	Wild-Type Research	Ma		YMa	Large black spot at dorsal base. Second black spot in abdoman at base of anal fin. Two red spots below dorsal base. Variation number & location of red spotting reported. Considered homozygous YY lethal.	Descended from O. Winge's "Spot Race".	Schmidt 1920, Winge 1922, Blacher 1928		
206	**Maculatus (red)**	Wild-Type Research	Ma		Y *Part of Ma*	Heteditary alteration of the Ma gene was recorded in 1933. Expression maintained from 1935-1941. Not determined whether this represented a mutation or a cross-over event, orginating with male No. 1768. Considered homozygous YY	Descended from O. Winge's "Spot Race". See: Macula rubia.	Winge & Ditlevsen 1947, *reporting 1933 data*		
207	**Mean Brightness**	Wild-Type Research			X / Y / Autosomal	Quantatative means of measuring overall reflective qualities of color in male color / pattern ornaments. In breeder terms is equal to "intensity" of color.		Brooks & Endler 2001		
208	**Mean Chroma**	Wild-Type Research			X / Y / Autosomal	Quantatative means of measuring purity & intensity of color in male color / pattern ornaments. In breeder terms is equal to "density" of color.		Brooks & Endler 2001		
209	**Melanocortin 1 Receptor (MCR)**	Wild-Type Research				Gene that provides instruction for production of malanocortin 1 receptor, contributing to pigmentation. Primarily located on surface of melanocytes.				
210	**Minutus**	Wild-Type Research	Mi		X / Y	Color Chracter derived from Ruber; red in upper caudal rays.		Winge 1927		
211	**Oculatus**	Wild-Type Research	Oc		Y	Color Character and form of caudal fin. Upper margin of the caudal fin has a short string-like prolongation, often black-edged.		Schmidt 1920, Winge 1927		
212	**Orange Area**	Wild-Type Research			Y	Quantatative means of measuring purity & intensity of xantho-erythophores (Orange) color in male color / pattern ornaments.		Houde 1992		
213	**Orange Area**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
214	**Orange Brightness**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
215	**Orange Chroma**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
216	**Oval Tail**	Wild-Type Research	ov		Autosomal Recessive	Wild form having no prolongations. Matings indicated recessiveness of the wild ovaltail factors and excluded Y-linkedage or X-linkedage as primary mechanisms of [this] fin form. ovov (homo), Ovov (hete) and OvOv (non-Oval Tail).	Tail Neutral female. See: Color Neutral - female for color counterpart.	Hildemann 1951		
217	**Pauper**	Wild-Type Research	Pa		Y	Color Character. Small, horizontally extend orange and white-iridescent set high up on the hinder part of tail. Occasionally, black anal speck and spot on breast; also little red in dorsal. Considered homozygous YY lethal.		Winge 1927		
218	**Purpureus**	Wild-Type Research	Pu		X / Y	Color character; Yellow dorsal w/minimal red spotting.		Natali & Natali 1931 (in Kirpichnikov 1981)		

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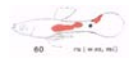
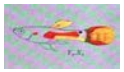
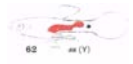
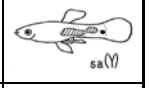
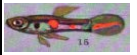
219	**Reflective Dorsal Spot**	Wild-Type Research		RDS **	Y	Color Character. Blue / Silver irid spot base of dorsal. Present in some Iridescens (Ir) and Smaragd-Iridescens (SmIr). Indicator of Wingei / Endler infusion. **Note: nomenclature added after publ.	See: Iridescens (Ir), Smaragd-Iridescens (SmIr), Metrika, Iridescent Area, Central Blue White Spot, Blue Iridescent Spot,	Bias 2013 [pub 12.16.13]		
220	**Reticulatus**	Wild-Type Research	Re		Y	Complex reticulated (net-like) pattern produced by melanophore concentration on scale edging, and too lessor degree central scale.		Natali & Natali 1931 (in Kirpichnikov 1981)		
221	**Rubra**	Wild-Type Research	Ru / r		X / Y	Color Character. Described 1922 by Winge. In 1927 he split Ruber (ru) into two traits; minutus (mi) and sanguineus (sa) based on breeding tests.	Anterior Rubra, also Ruber. Tanaka Ginga Rubra (over Ze). See Anterior Rubra, Bunt.	Winge 1922 1927, Blacher 1928		
222	**Sanguineus**	Wild-Type Research	Sa		Y	Color Character. Derived from Ruber.		Winge 1927		
223	**Solaris**	Wild-Type Research	So		X / Y	Color Character; Singular red spot in caudal/peduncle base.		Kirpichnikov 1935		
224	**Streak**	Wild-Type Research			Y	Color Character; unknown in description.		Sherman, 1937 (*unpubl. Thesis*)		
225	**Sulfureus**	Wild-Type Research	S		X	Color Character. Sulphur yellow colour in the dorsal fin and a dark dot that only at time is visible. Sulphur yellow colour in the tail and caudal fin. Red Colour in the lower edge of the caudal fin.		Winge 1922b		
226	**Super Gene(s) Complex (female)**	Wild-Type Research			X / Y Dominant	Color Character. Super genes for both Coccineus-Vitellinus and Melano-Dorsal segregated from wild populations fully viable. Suggesting absence of recessive lethals in homozygous XX or XY. [***Note:*** *consists of two or more genes tightly linked to each other, and protected from recombination*]	X-linkeded Wingean Spotting with measureable crossover. Examples include Coccineus-Vitellinus and Melano-Dorsal.	Schimidt 1920, **Winge 1922a 1922b** 1923 1927 1939 1934, Winge & Ditlevsen 1938, Haskins 1970		
227	**Super Gene(s) Complex (male)**	Wild-Type Research			Y Dominant	Color & Pattern gene(s), located on non-pairing section of Y chromosome, showing single gene inheritance & dominant expression in males. Most often associated with orange spotting. [***Note:*** *consists of two or more genes tightly linked to each other, and protected from recombination*]	Y-linkeded Wingean Spotting with no crossover. Examples Maculatus, Armatus, Pauper. Considered homozygous YY lethal.	Schimidt 1920, **Winge 1922a 1922b** 1923 1927 1939 1934, Winge & Ditlevsen 1938, Haskins 1970		
228	**Tail Area**	Wild-Type Research			Y	Quantatative means of measuring caudal traits, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
229	**Tigrinus**	Wild-Type Research	Ti		X	Color Character. Barred pattern of vertical stripes on the peduncle. Effect resembles that of Zebrinus, but is as a rule less pronounced.		Winge 1927		
230	**Total Spot Number**	Wild-Type Research			X / Y	Quantatative means of measuring orange in male color / pattern ornaments, in regard to attractiveness and/or mating success at the phenotypic and genetic levels. Used to determine as a single value in estimating overall fitness.		Brooks & Endler 2001		
231	**Trimaculatus**	Wild-Type Research	Tri		Y	Color Character; Red in caudal, Series of three orange spots along lateral line.		Natali & Natali 1931 (in Kirpichnikov 1981)		

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232	**Variabilis**	Wild-Type Research	Va		Y	Color character. Apparently not homologous with variabilis of Winge. Produces yellow colorin dorsal region of caudal fin.		Blacher 1927 1928, Goodrich 1929		
233	**Variabilis**	Wild-Type Research	Va		Y	Color Character. Milky, somewhat labyrinthine pattern in the upper part of the caudal find, which is here inclined to extend out into a point.		Winge 1927		
234	**Viridis I & II**	Wild-Type Research	Vir		Y Dominant	Color Character; Blue-Green anterior lower belly spot visible in males. Strictly Y-linked. Suggested differentation: Vir I (single spot) & Vir II (two spots). Phenotypical evidence in outcross suggestive of Vir as full body modifier.		Natali & Natali 1931 (in Kirpichnikov 1981), Natali & Natali 1931 (in Dzwillo 1959)		
235	**Vitellinus I & II**	Wild-Type Research	Vi		X / Y	Color Character derived from Sulphureus.		Winge 1927, Natali & Natali 1931 (in Dzwillo 1959)		
236	**Zebrinus**	Wild-Type Research	Ze		Autosomal Dominant	Color Character; Barred pattern of vertical stripes on the peduncle, viz. 2-5, generally 3 dark pigment stripes. Effect resembles that of Tigrinus gene, but is as a rule more pronounced. ZeZe (homo), Zeze (hete) and zeze (non-		Winge 1927		
237										
238										
239										
240										